The Brain Bone's Connected to the MBONE

by Kevin M. Savetz

In its short history, the Internet has seen more than its share of revolutions. First came the revolution in global communications with email and Usenet. After that there was the revolution in information sharing with FTP and Gopher. In the past few years, the World Wide Web has revolutionized the presentation of information. Governments, magazines, television networks, businesses, and any number of other organizations are turning to the Web as a new means of getting to their audience.

But the most significant revolution of all might well be the one merely around the corner. With the development of something called the MBONE, the Internet suddenly becomes a hotbed of real-time multimedia communications.

In essence, it becomes a brand of interactive boardroom, classroom, television, cinema, videogame, and edutainment—of the kind only dreamed of in the hype about the information superhighway. The MBONE will make it possible, eventually, for all of us to start our own Internet-based TV show, if we wish, without so much as an FCC license or a transmitter. Or to teach in an online classroom with students from ten different states. Or to participate in an important videoconference with researchers from around the globe.

On the Internet, and typically in real life, new technologies are first available to a core group of inventors and experimenters. If it's good enough or interesting enough or worthwhile enough, word gets out. Other folks begin to hear the wonders of the new technology; they want to try it out; they find out what they need; then they spend whatever time and money is necessary to join in. Slowly, the technology gains wider and broader acceptance, with more and more people taking part, until at last it becomes so common that it's practically a household word. Take, for example, electronic mail, or the World Wide Web, or the waffle iron.

MBONE will make it possible, eventually, for all of us to start our own Internet-based TV show, if we wish, without so much as an FCC license or a transmitter.

Over the past few years, the MBONE has been making its way onto the Internet slowly and experimentally. But its speed of adoption may be about to increase exponentially, because even those of us who today rely on home computers and mere modems will soon have access to the technologies necessary to bring it into our homes.

Today, we "regular Internet users" are at the cusp of a new multimedia revolution. Those of us pushing the limits of a 14.4k bps connection can already use of some cool new multimedia tools (see my last article on radio on the Net) In the coming months, true multimedia will become more commonplace for "regular users" as our bandwidth limitations decrease and as hackers continue to improve compression methods for stuffing more information down that thin 14.4k bps link.

What is the MBONE?

The Internet has traditionally been built to send information to one person (or computer) at a time. The information being transmitted has a specific destination in mind, such as an email message that tries to reach a specific (single) colleague. A request for a Web page is transmitted to a single host, and the host sends back the requested information to the single recipient. Although computers can handle hundreds (or thousands, or millions) of these requests every second, the information being moved around is still one-to-one. One computer is sending the information, and only one is receiving it.

This seems like a perfectly fine arrangement, until you consider what happens when you want to send information simultaneously to more than one person. Let's use an email message as an example, one to which you've attached a graphics file. If you send that message to your friend in England, you'll chew up a certain amount of bandwidth. Now, as any seasoned Internaut knows, you can address an email message to two, three, or twenty people at the same time. If you send this file to all twenty, you create twenty times as much Internet traffic. So if a band like R.E.M. wanted to transmit a live concert across the Internet to 150,000 of its clos-

est friends, well, you can easily imagine how quickly the Net would clog up.

The next generation of groundbreaking tools on the Internet will be "IP multicast" or "MBONE" programs. These tools change the rules of the road: they allow packets of information to be "broadcast" to anyone who is "listening" rather than to a single, specific individual or computer. These packets aren't sent individually to each recipient; instead, only one stream gets sent, but it ends up at all the specified destinations at (more or less) the same time—this is called "multicasting".

You can think of multicasting as the Internet's version of broadcasting. A site that multicasts information is similar in many ways to a television station that broadcasts its signal. The signal originates from one source but can reach everyone in the station's signal area. The signal takes up some of the finite available bandwidth, and anyone with the right equipment can tune in. For those who don't want to catch the signal, or don't have the right equipment, the information passes on by.

Why is this interesting? Because IP multicasting lends itself to a whole new way to publish information on the Internet. Instead of the electronic equivalent of a one-on-one chat, you can have a megaphone, broadcasting to everyone who cares to listen. And the people who do the listening can send something right back, not just to you but to everyone else as well.

The MBONE—which stands for "multimedia backbone"—is today's implementation of IP multicasting. As the MBONE gathers steam, it promises a thorough and irrevocable shift in how the world communicates. It promises, in others words, a revolution of its very own.

MBONE is for Power Users

Although the MBONE is free to use for anyone who has the right equipment, the hardware and connectivity requirements are much greater than those of the common home Internet user. A PC or Macintosh system coupled with a standard modem doesn't have enough computing power or bandwidth to send or receive MBONE transmissions.

You need a good deal of power to handle multicast IP. Today, multicasting software—the behind-the-scenes tools for moving, encoding, decompressing and manipulating multicast packets—is only available for high-end UNIX workstations, such as those from Sun, DEC, HP, IBM, and Silicon Graphics.

This is changing, however. Multicasting tools are becoming available for Linux—a free UNIX-like operating system that runs on (relatively) cheap IBM PC-compatible computers. Since MBONE tools can work on a Linux-based PC, it's not too much to imagine that soon, MBONE tools will be available for home computers like PCs running Microsoft Windows and the Macintosh. It will probably take the most powerful home computers (with Pentium and PowerPC chips), but it seems to be a likely eventuality. The software tools are being built. PC/TCP v2.3 from FTP Software, Inc. supports multicasting for PCs, as does Windows 95, and it is rumored that the next version of MacTCP will support multicasting.

Even for those who have the hardware to do multicasting today, there's another huge hurdle preventing the MBONE from taking over the Internet.

That hurdle is bandwidth. Most of us just don't have enough of it. A multicast video stream of 1 to 4 frames per second eats about 128k bps of bandwidth, about 9 times the speed of a 14.4k bps modem. Audio multicasts, partly because of their lesser bandwidth requirements, are more common on the MBONE than on video. Multicast audio typically uses 56 to 64k bps of bandwidth.

Today, there are about 1,700 networks (in about 20 countries) on the MBONE, meaning the MBONE is available on approximately 3 percent of the Internet.

The MBONE needs to come a long way—overcoming today's limitations in bandwidth and computing power—before it becomes a household word.

However it's very likely that within the next few years—given the growing popularity of ISDN and the advent of improved data compression techniques—the MBONE will become the next "killer app" of the Internet.

With the MBONE, you can

- collaborate with colleagues in real time using a shared virtual "whiteboard"
- hear and see live lectures from famous professors or scientists, and even ask them questions
- listen to radio stations "broadcasting" on the Internet
- if you are so inclined, start your own radio show
- see live pictures of spacebound NASA astronauts working on the Space Shuttle
- attend a virtual poetry reading, hearing the speech in the author's own voice
- see and hear rehearsals of Silicon Valley garage bands
- attend an Internet Engineering Task Force meeting without leaving your office

…And although the following things haven't happened yet, in the future the MBONE may allow you to

- watch a customized version of CNN right from your computer's desktop
- engage 5,000 other people in a huge intercontinental computer game
- see reruns of Gilligan's Island, and share your snide comments in real time with far away friends
- put your own garage band's rehearsals online for all to see (and hear)
- automatically download and install authorized upgrades and bug-fixes to your computer software, without your intervention
- "chat" in real time with 20 others—like with the current Internet Relay Chat, except using your voice instead of your overworked fingers
- do plenty of other things that haven't been thought of yet.

Copyright 1995 by Kevin Savetz. This artilce is excerpted from MBONE and the Future of Internet Multimedia (IDG Books, 1996)